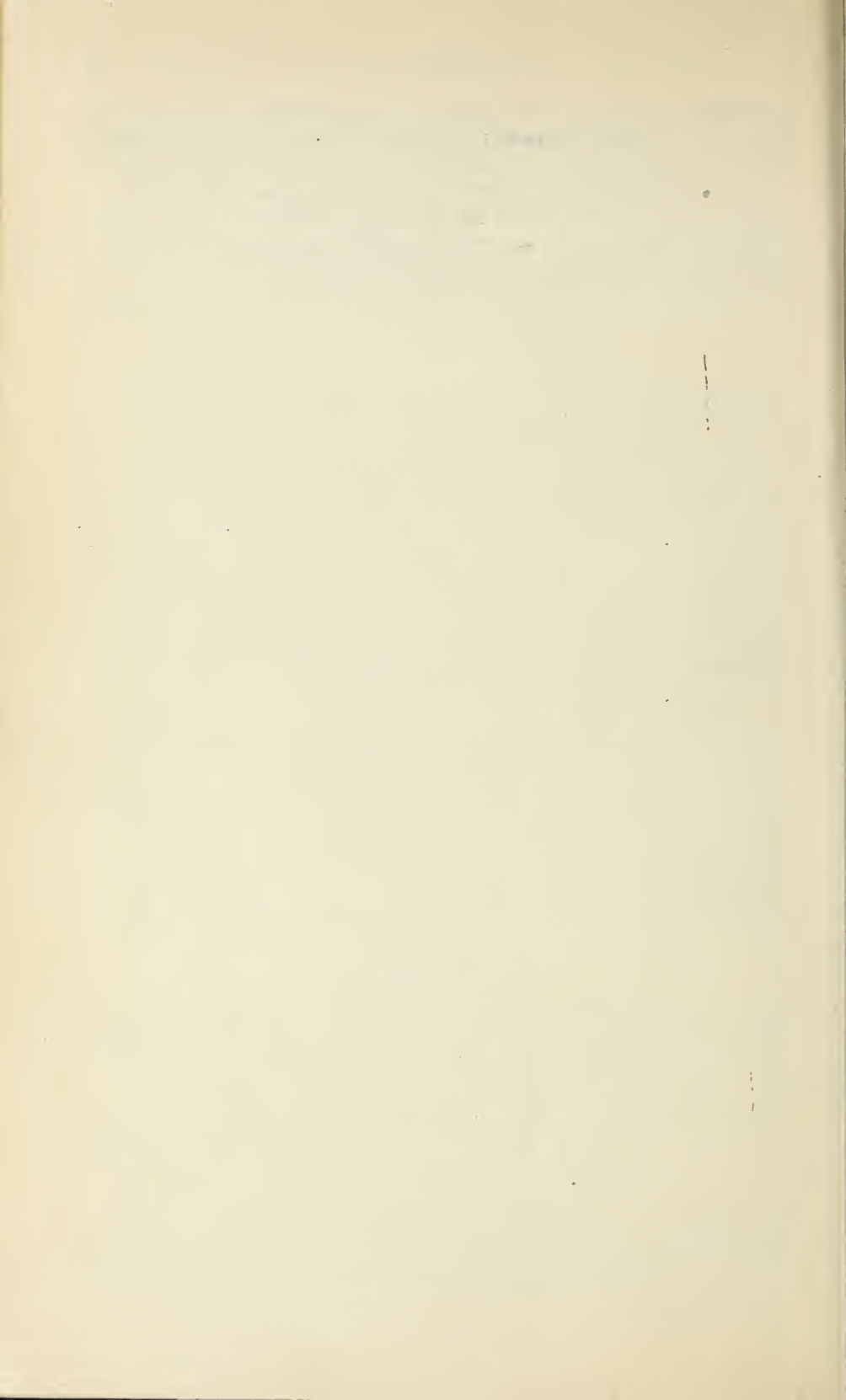


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CONTROL OF WATERMELON ANTHRACNOSE BY SPRAYING

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Watermelon Anthracnose

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(Office of Cotton, Truck, and Forage Crop Disease Investigations)

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WATERMELON ANTHRACNOSE has come to be recognized as a disease of major importance. This trouble annually causes an enormous loss in our commercial watermelon territory, for the reason that when fields are attacked the yield is reduced and the quality of the fruit lowered. The disease occurs on other vine crops, among them the cucumber, muskmelon, and some varieties of gourds; consequently, it has come to be widely distributed. If the weather conditions are suitable, anthracnose is likely to occur in any section where watermelons are grown. The disease may cause loss to the farmer, transportation company, or distributor. This being the case, all parties concerned with the crop should cooperate in the introduction of control measures, the most important of which is spraying. A good start was made in 1919, when more than 3,400 acres of watermelons were sprayed in Florida. There are some sections of the melon territory where spraying is already recognized as a necessary step in good melon culture, and it is believed that before long the practice will be general.

CONTROL OF WATERMELON ANTHRACNOSE BY SPRAYING.¹

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SPRAY WITH BORDEAUX MIXTURE.

THE MOST PRACTICABLE METHOD of reducing the damage done by anthracnose is to spray the watermelon vines with 4-4-50 Bordeaux mixture. If anthracnose spores are carried to healthy melon vines, they will become diseased unless protected by a



FIG. 1.—Ineffectual spraying for watermelon anthracnose. This field was sprayed once with 1-4-50 Bordeaux mixture, which proved too weak to control the disease. Compare with figure 2.

coating of spray mixture, which prevents the germination of these spores and the development of the fungus. (Figs. 1 and 2.) Thorough applications of Bordeaux mixture will prevent the spread of anthracnose and will help to control other diseases of the crop.

¹This circular summarizes the results of a personal experience of four seasons in the watermelon territory, and it is believed that the methods outlined are applicable wherever anthracnose occurs.

The writer wishes to acknowledge the assistance of the following men in the collection of information regarding spraying: H. E. Stevens and C. D. Sherbakoff, pathologists, Florida Agricultural Experiment Station, Gainesville, Fla.; J. B. Berry, pathologist, College of Agriculture, Athens, Ga.; M. L. Benn, C. M. Tucker, and A. H. Slocum, formerly field aids in plant pathology, Bureau of Plant Industry; D. H. Gilbert, Monticello, Fla.; G. H. Thorpe, Dry Branch, Ga.; and C. B. Michelson, supervisor of farm marketing of the St. Louis-San Francisco Railroad. Much credit is due the Melon Distributors' Association. This organization has taken an active interest in the disease-control work as a whole, and the members have rendered invaluable assistance by the dissemination of information with regard to spraying.

WHEN TO SPRAY.

One must remember that spraying is a preventive, not a cure, and that it is effective only to the extent that the surface of the healthy plant is kept covered with a thin coating of the spray solution. Knowing this and the fact that the disease spreads rapidly during and immediately after rainy weather, the farmer must choose the proper time for the application. The following schedule will serve as a guide for making this selection:

Make the first application when the vines begin to run.

Spray the second time about one week after the first melons have "set" on the vines.

Make a third application about two weeks after the second.

If anthracnose appears and the above schedule has not been used, try these emergency measures: Spray with Bordeaux mixture immediately and repeat the operation about 10 days later. If rains are



FIG. 2.—A field in which the watermelon vines were sprayed five times with 4-4-50 Bordeaux mixture. The foliage was heavy at shipping time and the melons were not spotted.

frequent at this time a third spraying will probably be required. Cases have been known where it was necessary to spray during the loading period in order to secure a profit from the crop.

HOW TO SPRAY.

THE SPRAY PUMP.

The man who intends to spray his watermelons should prepare well in advance. A good spray pump should be secured, and his laborers should be made thoroughly familiar with the operation of the equipment. If the grower has a small acreage he may be able to unite with one or two neighbors in the purchase of a pump and materials. In order that sufficient pressure may be maintained

gasoline-power equipment is almost essential for successful work with watermelons, although if the acreage is small, 10 or 15 acres, it may be necessary for purposes of economy to use a hand pump. Growers in certain sections of Florida and in central Georgia have found that the outfits used for spraying citrus fruits, pecans, and peaches may be adapted for use with watermelon vines. Orchard apparatus, however, is rather heavy for use in sandy fields. Several firms manufacture light gasoline-power outfits with the tanks mounted on two wheels, and these have many advantages for work with watermelons, particularly if stumps are abundant. (Figs. 3 and 4.) In buying an outfit, care should be taken to secure all the clearance possible between the ground and the bottom of the tank. Since Bordeaux mixture contains copper sulphate the pump should be lined with brass or porcelain.

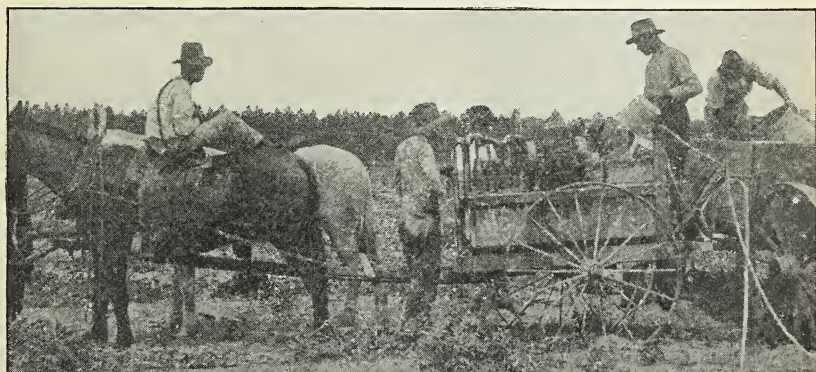


FIG. 3.—Filling the spray tank in the field. This type of pump, in which the tank is mounted on two wheels, is manufactured by several companies. Such a machine is particularly well adapted for use where stumps are abundant. Time is saved by hauling the mixture to the field, so that the pump may be kept in continuous operation until the field is covered. A galvanized-iron bucket, like the one shown, should never be used for dipping Bordeaux mixture, as the mixture attacks iron. A wooden bucket should be used instead.

EQUIP THE SPRAYER TO SUIT THE FIELD IN WHICH IT IS TO BE USED.

The number and arrangement of leads of hose depend on the field in which they are to be used and the method of spraying. In general, the spray is applied by driving down a middle and spraying two or more rows on each side of the machine. (Fig. 5.) If the rows are 10 feet apart and the vines are kept turned back throughout the season to give driveway in those middles that are to be used for this purpose, very little injury will be caused by the passage of the machine. Folding booms will usually be found useful to support the hose. In some cases, however, stumps and trees may be so abundant as to prevent the use of booms, in which case it will be necessary to employ boys to carry the hose in order to prevent injuring the vines. (Fig. 6.)

APPARATUS, SPRAYING MATERIALS, AND LABOR REQUIRED.

The following outline has been prepared for the purpose of assisting the grower in the purchase of apparatus and supplies and in planning his work:

(1) Gasoline-power spray pump, able to deliver the spray mixture to six nozzles at 150 pounds pressure or more. The pump should be lined with brass or porcelain.

(2) Three leads of $\frac{3}{4}$ -inch hose, one 15 to 20 feet long behind the machine and the others each 30 feet long, extending one on each side of the machine and supported by a folding boom. Extra lengths of hose should be kept on hand.

(3) Three 4 to 6 foot bamboo extension rods, each equipped with a faucet cut-off at the hose end and with Y fittings at the nozzle end.

(4) Six angle (45°) disk nozzles, two for each extension rod. Extra nozzles should be kept on hand.

(5) Four or more wooden barrels for use in mixing the solution.

(6) Wooden buckets for dipping the bluestone solution.

(7) A strainer for the Bordeaux mixture made of brass wire having 18 meshes to the inch.

(8) Copper sulphate (bluestone).

(9) Quicklime (stone lime not air slaked). If necessary, hydrated lime may be used.

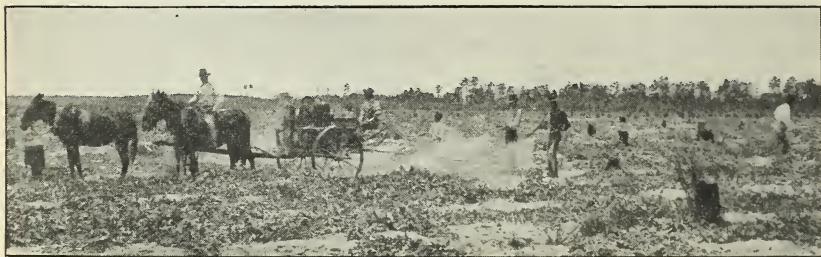


FIG. 4.—The pump in operation. As melons are frequently the first crop planted on new land, stumps are likely to be numerous. In such fields it is best to use a 2-wheeled machine, with the greatest possible clearance between the ground and the tank.

In ordering the spraying materials it is best to estimate in each case that about 4 pounds per acre will be required for each application.

The force required to operate such an outfit as that recommended will consist of a driver, three men to apply the spray, and a team of mules or horses. (Figs. 7 and 8.)

It is often convenient to have two additional men for preparing the Bordeaux mixture. If this work is done at some distance from the field, time may be saved and wear on the sprayer avoided by having the mixture hauled to the field in barrels. Boys to carry the hose are necessary when the booms suggested are not used.

If the outfit is handled effectively 25 to 50 acres and even more may be sprayed in one day.

COST OF SPRAYING.

In 1919 the cost of spraying an acre of melon vines once was about 95 cents. This includes the cost of labor and materials, but does not take into account the depreciation of the machinery.

PREPARATION OF BORDEAUX MIXTURE.

In order that spraying may be accomplished in an effective and economical way, it is necessary that the application be made quickly as well as thoroughly. Consequently, it is well worth while to prepare for mixing the solution in advance of the day on which the work is to be done by making stock solutions, from which the Bordeaux mixture can be prepared quickly.

Purchase quicklime (not air slaked) and copper sulphate early in the season, in such quantities as to secure wholesale prices. Provide wooden buckets for dipping the copper-sulphate and Bordeaux solutions and also four or more 50-gallon wooden barrels. These should be marked inside by driving several nails to indicate the



FIG. 5.—The 4-wheeled sprayer shown in figure 2 in operation. Four men are required to handle the outfit. One drives, the man behind sprays the first row on each side of the machine, and the other two men the second and third rows, right and left, six rows in all. The man in the rear is applying the spray by directing it sideways, holding the nozzle slightly above the foliage. This insures good penetration of the foliage.

water line when containing 25 gallons of water. Then one or more days before spraying, make stock solutions of bluestone and lime, proceeding as follows:

Place 25 gallons of water in a wooden barrel and dissolve 50 pounds of bluestone in this. This can be done conveniently by suspending a gunny sack containing the bluestone just below the surface of the water. About 24 hours will be required for the chemical to dissolve. Cover the barrel to prevent evaporation, or dilution in case of heavy rainfall.

Slake 50 pounds or more of quicklime in a barrel or trough and keep this covered with water until time for using it.

These stock solutions will make a sufficient quantity of Bordeaux mixture to cover about 12 acres of well-grown vines. If the acreage

is greater than this, larger quantities of the stock solutions should be prepared, using the proportions specified above.

When ready to spray—

(1) Pour 2 gallons of the copper-sulphate stock solution in a third barrel and add water to make 25 gallons.

(2) In a fourth barrel, add about 6 pounds of slaked lime to 25 gallons of water and stir thoroughly.

(3) Pour the two solutions through a strainer into the spray pump. If a hand pump is used stir the mixture well; if a power sprayer is used operate the agitator while running the mixture into the tank.

The result of the above procedure will be 50 gallons of Bordeaux mixture, a sufficient quantity to cover about 1 acre of well-grown

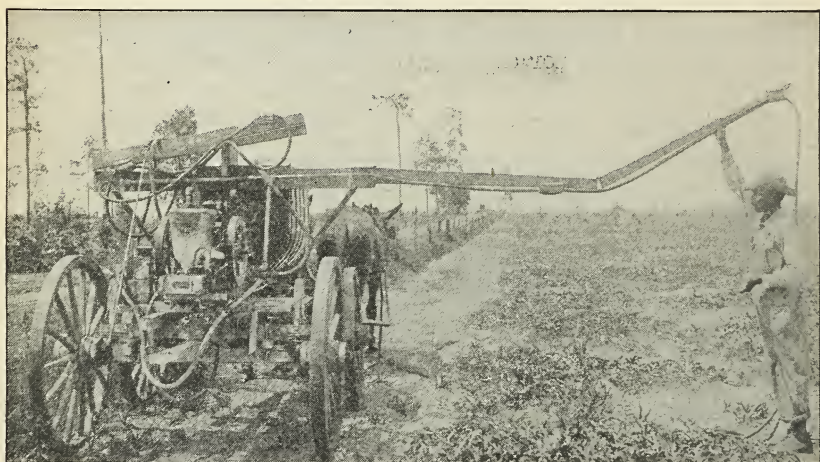


FIG. 6.—A 4-wheeled power sprayer rigged with three leads of hose. The home-made folding boom saves the expense of employing a boy to hold the hose.

vines. If a large acreage is to be sprayed it is often found convenient to use larger barrels and to elevate these on a mixing platform in such a way that the stock solutions may be piped instead of dipped and the resulting dilutions allowed to run into the spray pump.

In order to make sure that the copper sulphate is properly neutralized by the lime, Bordeaux mixture may be tested by what is known as the ferrocyanid test. An ounce of yellow prussiate of potash is dissolved in a pint of water, and a drop of this solution is allowed to fall on the surface of the spray mixture. If free copper is present the drop will immediately turn reddish brown in color. Lime milk should then be added until the brown color fails to appear. If the reaction is complete the yellow prussiate of potash solution will remain a clear yellow until it disappears into the mixture.

NATURE OF THE DISEASE.

APPEARANCE OF DISEASED VINES.

Anthracnose is caused by a microscopic plant, a fungus known as *Colletotrichum lagenarium*. Vines attacked by this fungus may be recognized by the numerous irregular black spots which appear on the leaves. When heavily infected, the foliage tends to shrivel and curl, and after a period of heavy rainfall, when the disease has spread rapidly, farmers often speak of their field as having been

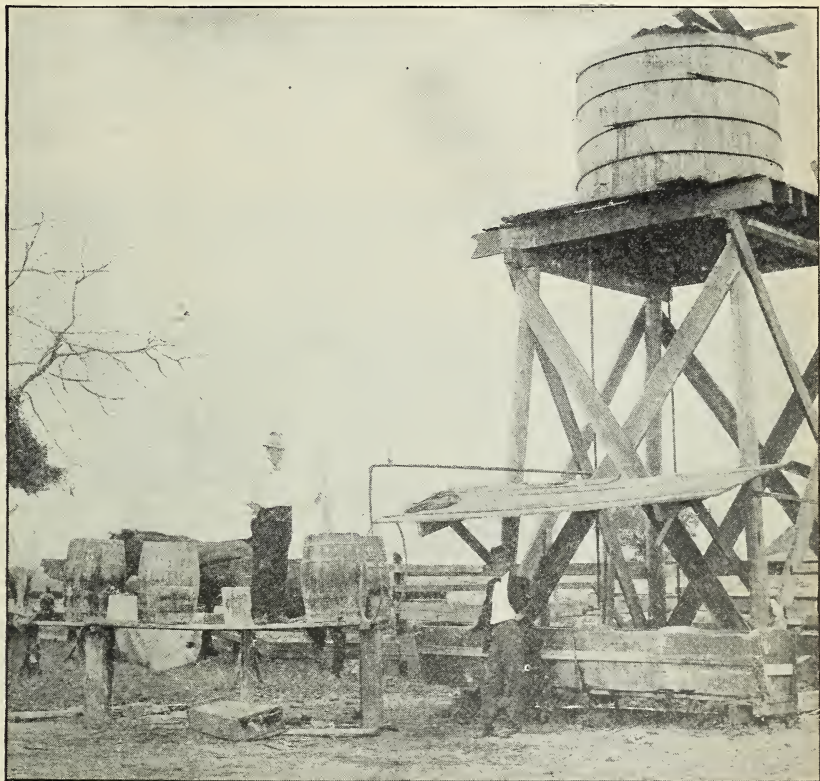


FIG. 7.—A Bordeaux mixing station. The spray mixture should be prepared in a place where water is readily accessible. It may then be hauled to the field and pumped or poured into the spray tank. A tank filler that may be attached to the pump is often a great saver of time and labor.

“burned over,” owing to the fact that the leaves in large areas have been crisped and blackened by the fungus. Many growers attribute the injury to excessive rainfall. This is in part true, as moist conditions are necessary for the growth and development of the fungus and consequent spread of the disease. If one examine diseased leaves carefully after a prolonged period of wet weather during which the leaf tissue has been kept moist, so that the fungus has had an

opportunity to develop, it is often possible to see an orange-pink layer partially covering the black spots. This is due to the presence of countless spores, microscopic fungous seed bodies, which spread the disease.

APPEARANCE OF DISEASED FRUIT.

Very young fruits when affected by the disease are likely to become deformed, and this is usually accompanied by the formation of irregular, black, sunken spots or light-green pimples with a yellow cast in the center. Pink spore masses often form on these at an early date.

If infection does not occur until the melon has reached a weight of about 10 pounds or more the trouble is marked by small pimples or larger flattened elevations on the rind. These spots are often spoken of by farmers as "rain checks," "smallpox," "pock marks,"



FIG. 8.—Hauling Bordeaux mixture to the field by truck.

etc. When conditions are very moist in the field or when such melons are loaded and held for some time in a freight car bedded with wet straw or sawdust, these pimples become sunken and covered with masses of pink spores. Such spots often furnish a point of entrance to other organisms of decay.

METHODS BY WHICH THE DISEASE IS SPREAD.

There are numerous ways in which the spread of anthracnose may be accomplished. Spores may be spattered by raindrops to leaves near by or washed to the ground, where they are carried along to other plants by drainage water. Laborers often disseminate the disease, particularly if culls are removed or melons harvested while the vines are wet with dew or rain. Under such circumstances, spores are likely to be carried on hands and clothing from diseased vines to healthy ones. If spores lodge on the melon itself, the characteristic anthracnose lesions form.

EFFECT OF THE DISEASE ON YIELD.

Assuming that there is for a start a single diseased vine in the field, the effect on the crop is largely dependent on weather conditions. Abundant rainfall leads to the rapid spread of the disease. If heavy rains prevail early in the season it is possible that the foliage will be completely destroyed before any fruit is matured. It is more often the case, however, that the trouble spreads rapidly shortly before or during the shipping time in a given locality, as this is likely to be a period when showers are frequent in the South-eastern States. Under these circumstances, much of the fruit shipped is removed from dead vines and is likely to be sunburned, severely spotted, and of inferior quality. In such cases the shipment may result in loss, not only to the grower but to the railroad and dealer as well.

GENERAL SUGGESTIONS.

Avoid introducing anthracnose and other diseases into the field on the seed. If the grower saves his own seed, a selection of disease-free seed stock should be made from healthy vines.

Do not plant melons on the same land two years in succession. Not only anthracnose but other serious diseases live over from one season to another in the soil.

Unless necessary, do not work among the vines when they are wet. This is a good time to spread disease if any is present.

Select a bright, sunny day for spraying, in order that the mixture will dry thoroughly.

If possible, avoid spraying when the heavy bloom is on, as great care must be taken at this time to avoid breaking off blossoms with the hose.

Order quicklime and bluestone in advance. In an emergency hydrated lime, in amounts one-fourth to one-half greater than quicklime, may be used. Bordeaux mixture so made should be tested with ferrocyanid of potash. Never use air-slaked lime.

Make the Bordeaux mixture carefully. If it contains more than 4 pounds of bluestone to 50 gallons the foliage may be severely burned. Never use an old mixture. The spray must be prepared fresh just before it is used.

It has been the writer's experience that homemade Bordeaux mixture is more satisfactory for spraying watermelons than any of the commercial preparations. If one intends to use prepared Bordeaux mixture it is desirable to know the strength and also the value of the preparation in terms of cost of materials. Farmers Bulletin 994, entitled "Commercial Bordeaux Mixtures: How to Calculate Their Values," should be read in this connection.

Always wash out the equipment with water after spraying.

